

Organic Aerosol Volatility Parameterizations and their Impact on Atmospheric Composition and Climate

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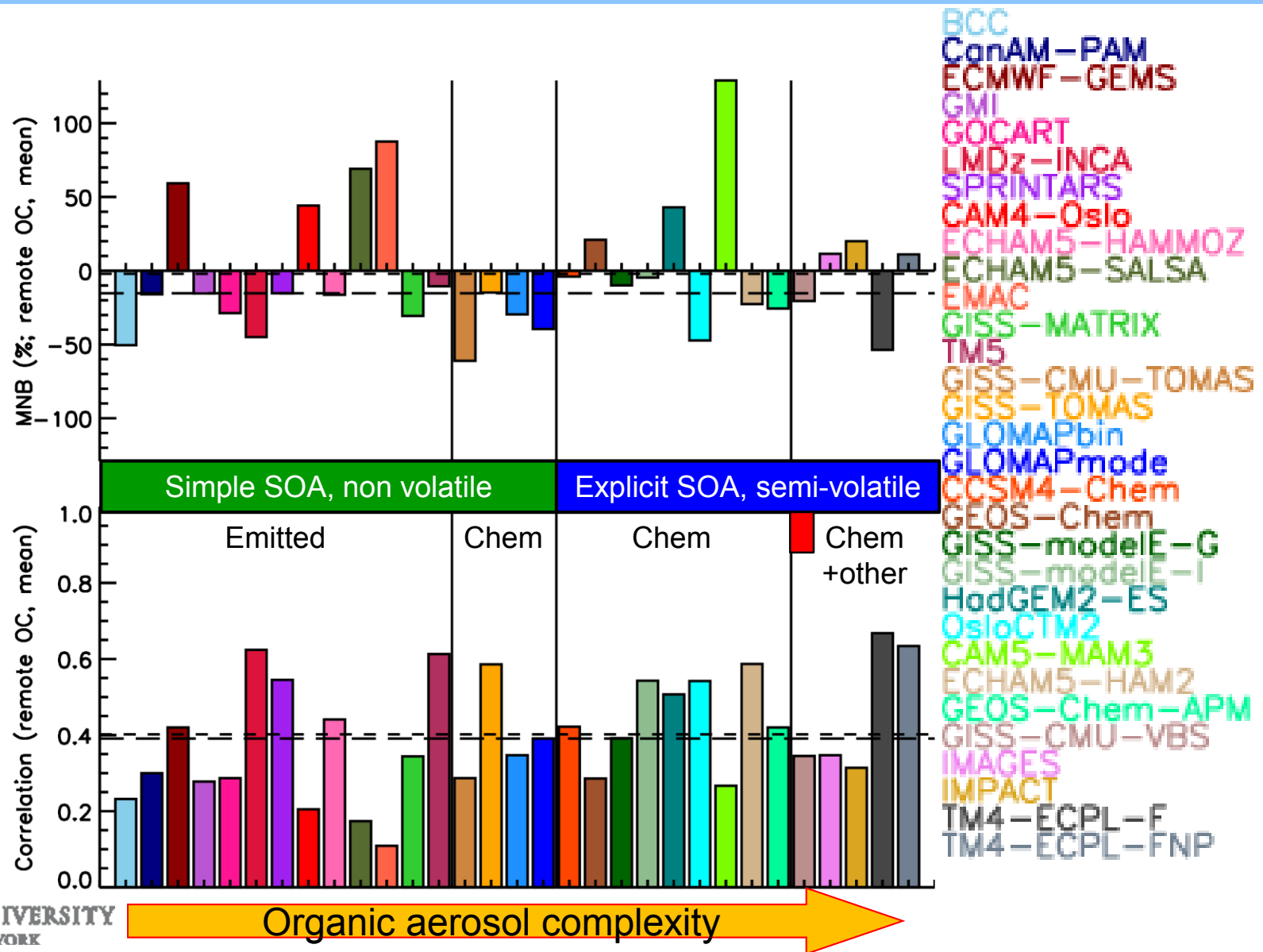
OA volatility in global models

	Volatility		Emissions		Chemistry	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
noSOA	Non-volatile	Non-volatile	BB+Anthro	0.15*(Terp)	Aging	Aged

Dentener et al., 2006

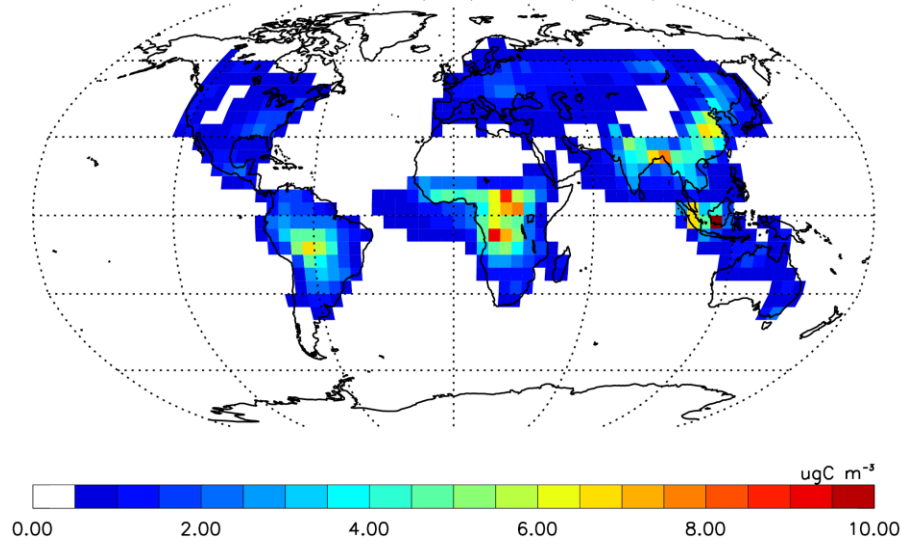
To take into account the intermediate volatility organic compounds (IVOCs);
Shrivastava et al., 2008.

Global model skill against OA measurements

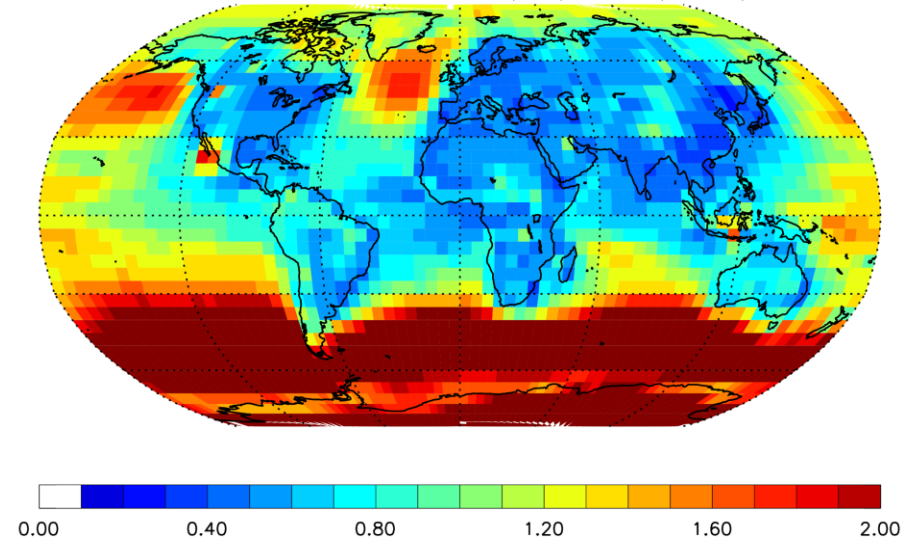


Median model – surface

Median model (5x5) – OC (Annual)

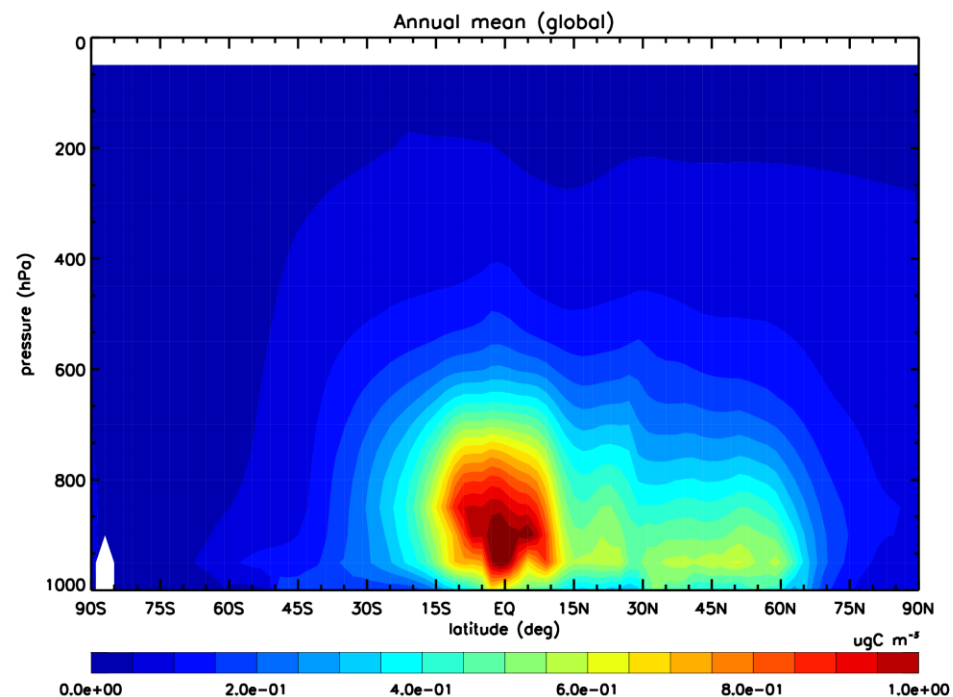


stddev-to-mean of models (5x5) – OC (Annual)



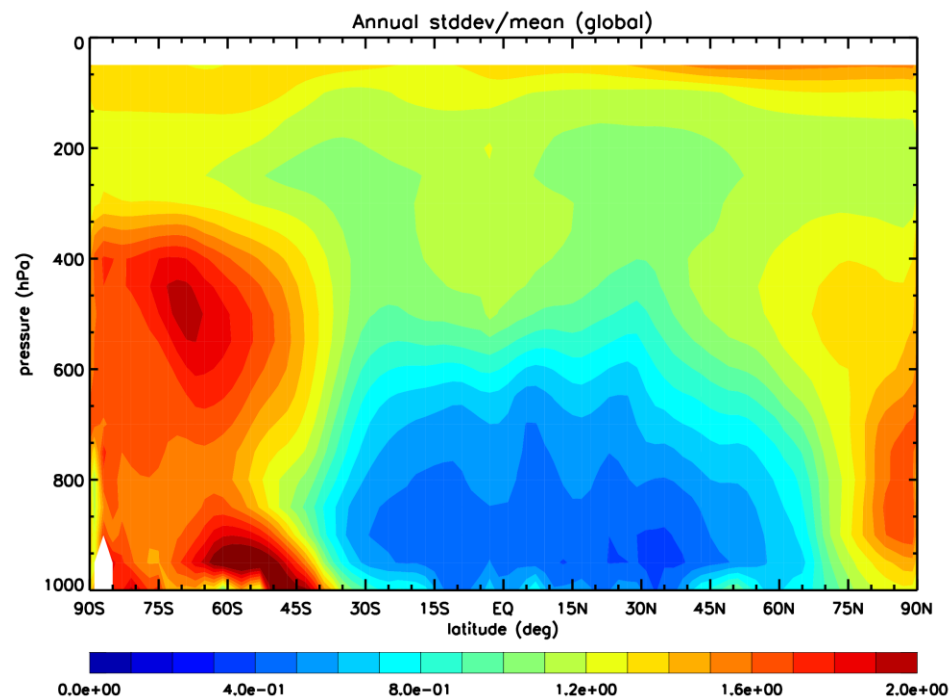
Median model – vertical

Model median



$1 \mu\text{gC m}^{-3}$

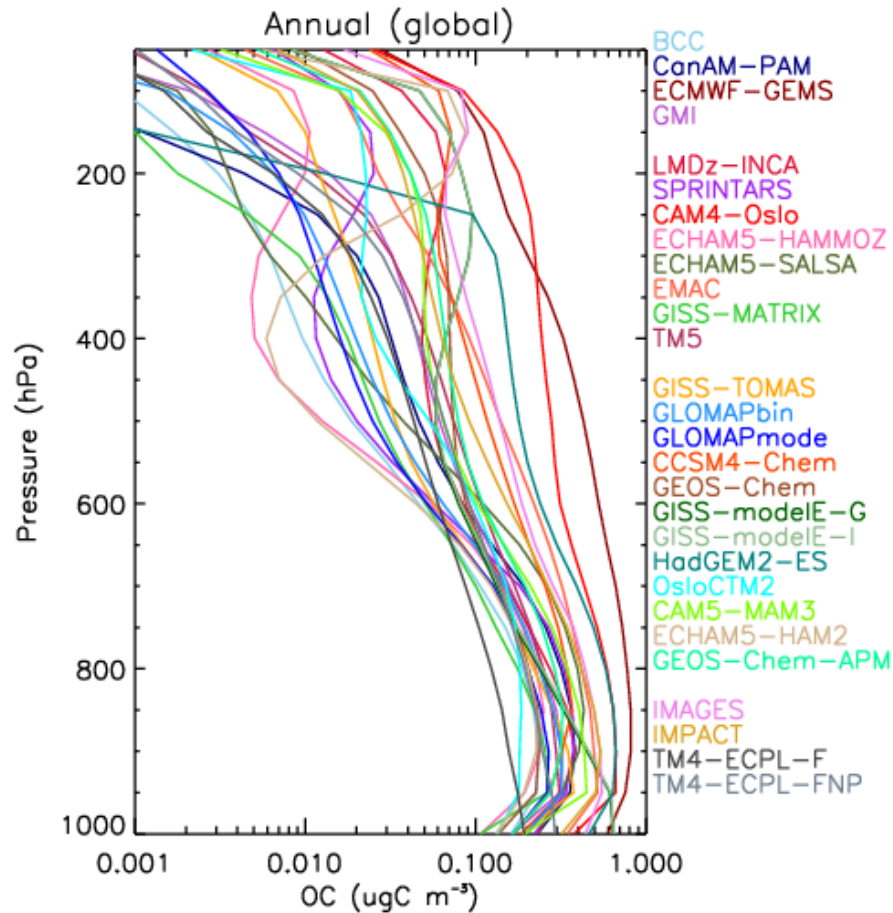
Model diversity



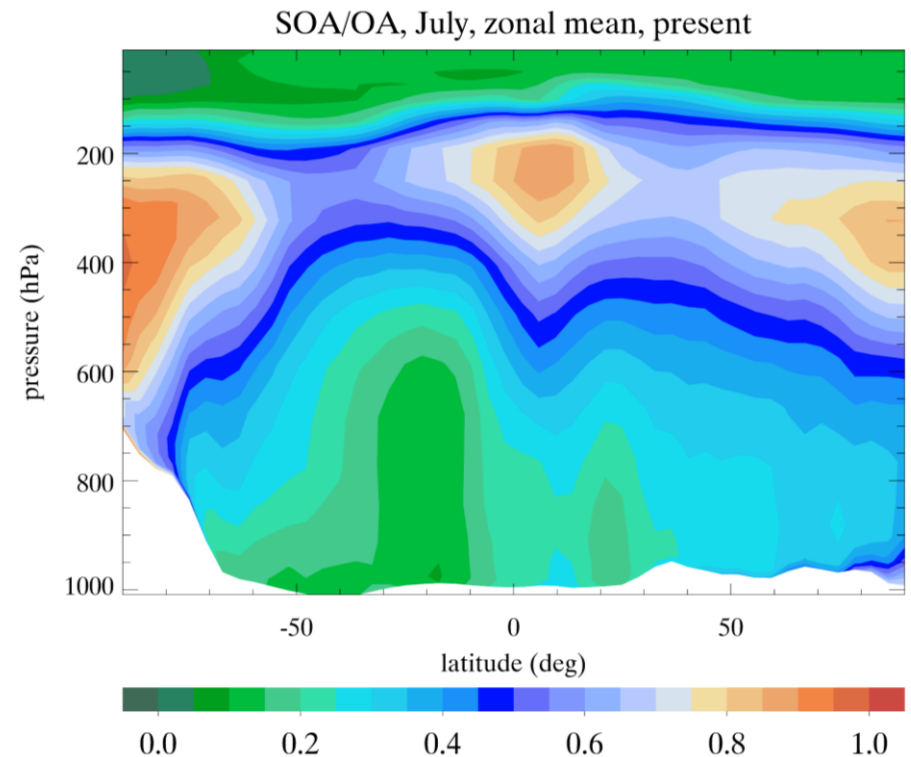
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Vertical profile

Tsigaridis et al., 2014



Kanakidou et al., 2005



OA volatility in global models

	Volatility		Emissions		Chemistry	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
noSOA	Non-volatile	Non-volatile	BB+Anthro	0.15*(Terp)	Aging	Aged
SOA	Non-volatile	Semi-volatile	BB+Anthro	Terp+Isop	Aging	Oxidation
VBS	Semi-volatile	Semi-volatile	2.5*(BB+Anthro)	Terp+Isop	Oxidation	Oxidation

	Aerosol parameterization
OMA	One-moment aerosols (bulk)
MATRIX	Aerosol microphysics

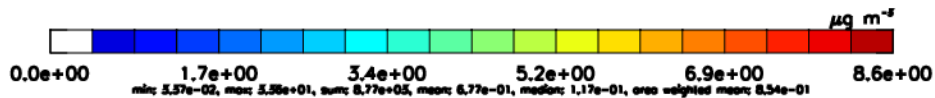
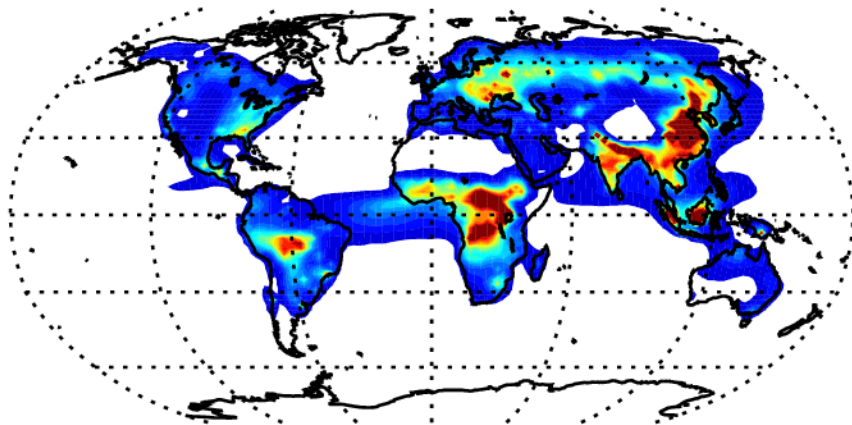
Dentener et al., 2006

To take into account the intermediate volatility organic compounds (IVOCs); Shrivastava et al., 2008.

OA at surface

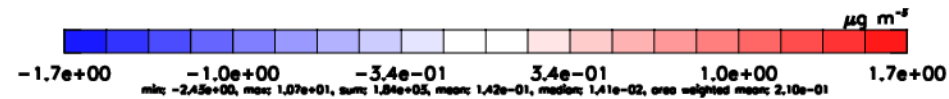
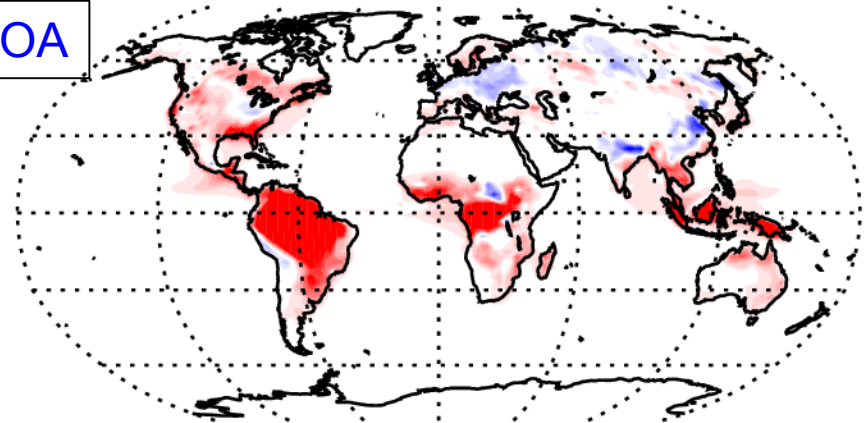
SOA

OA: OMA-SOA

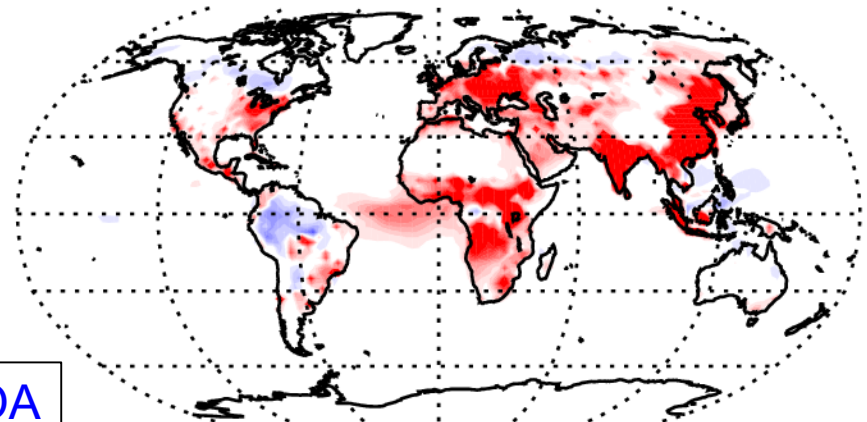


noSOA - SOA

OA: OMA-noSOA - OMA-SOA



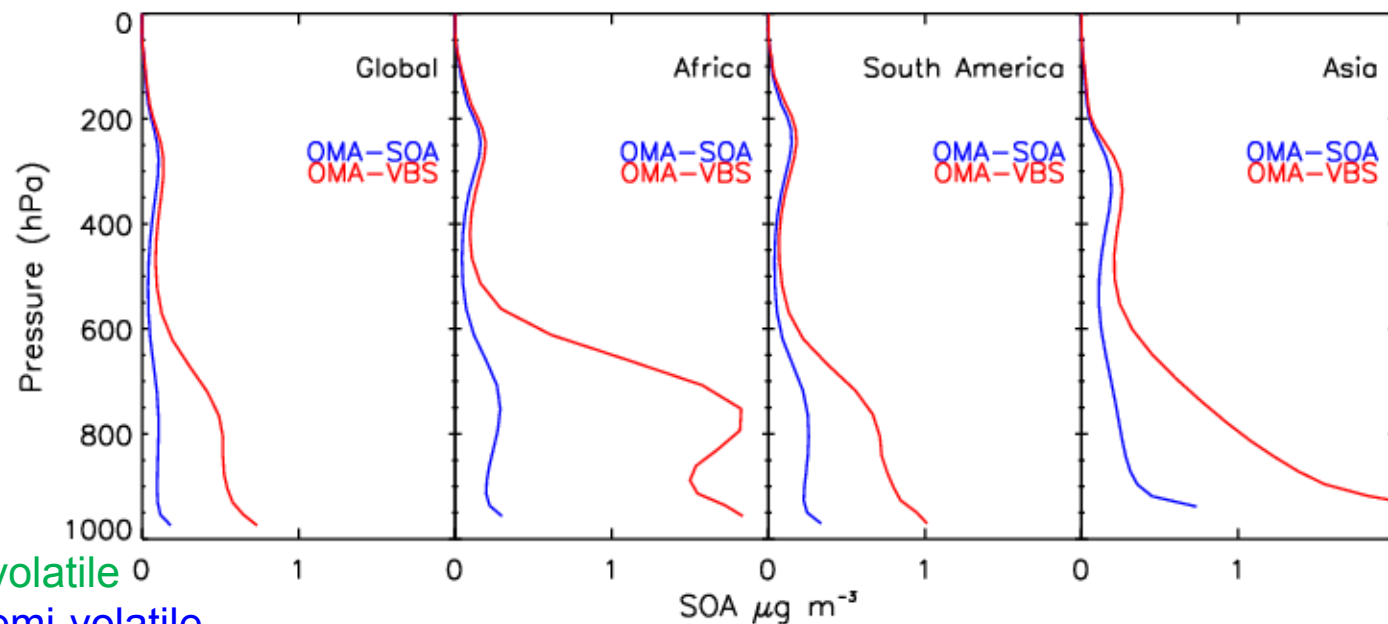
OA: OMA-VBS - OMA-SOA



VBS - SOA

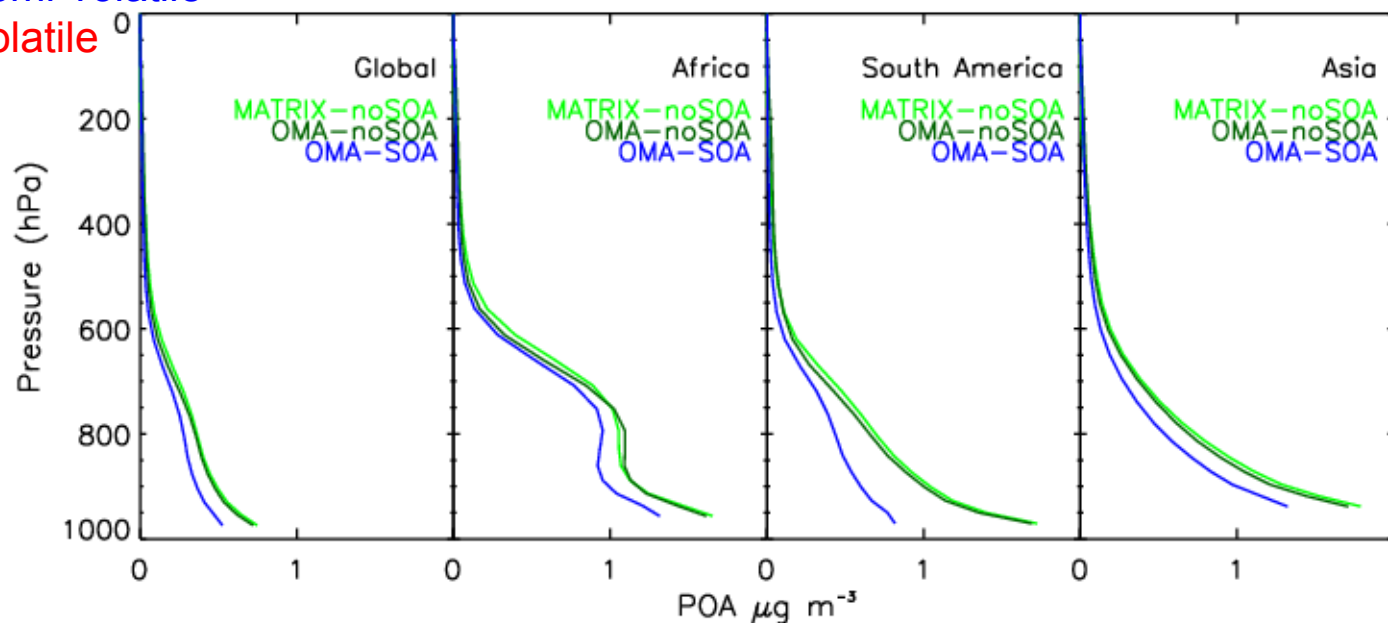
POA/SOA vertical distribution

Secondary



Green: All organics non-volatile
Blue: All biogenic SOA semi-volatile
Red: All organics semi-volatile

Primary

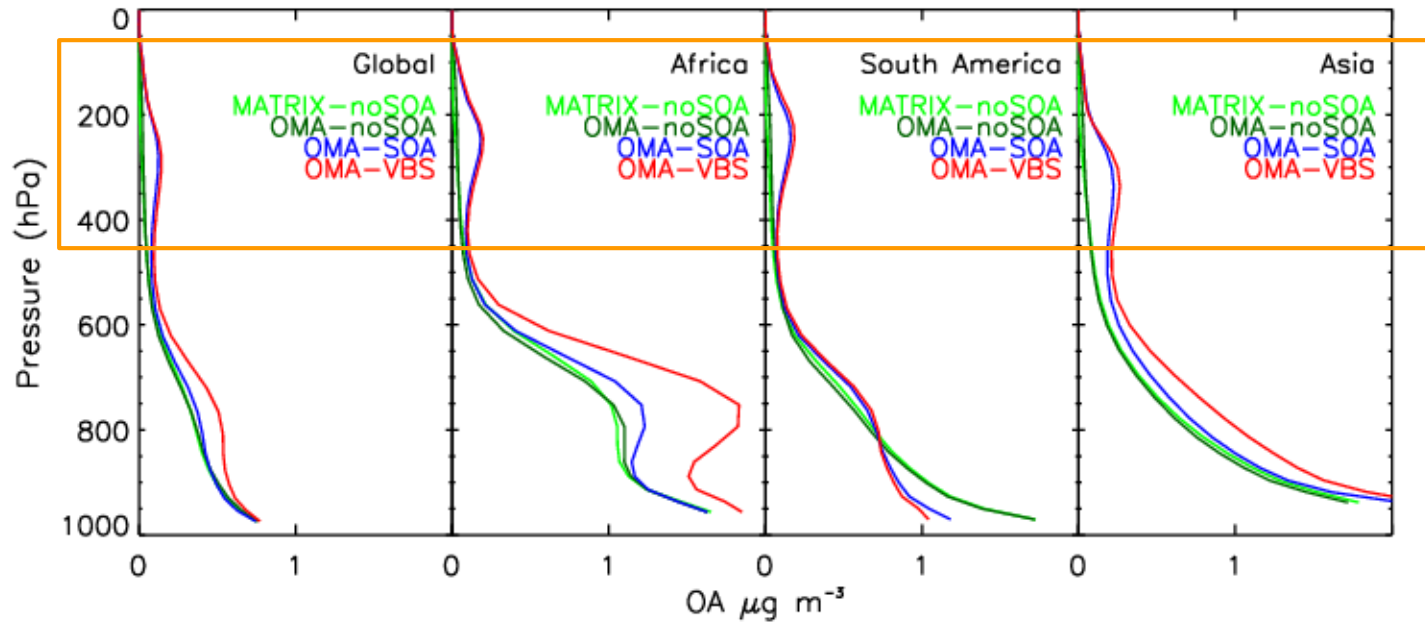


OA vertical distribution

Green: All organics non-volatile

Blue: All biogenic SOA semi-volatile

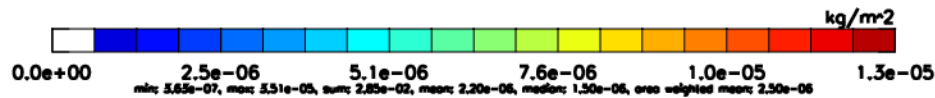
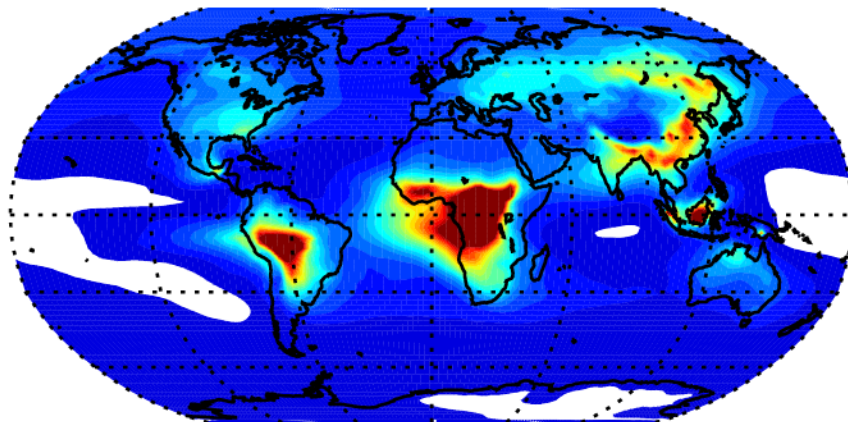
Red: All organics semi-volatile



OA column burden

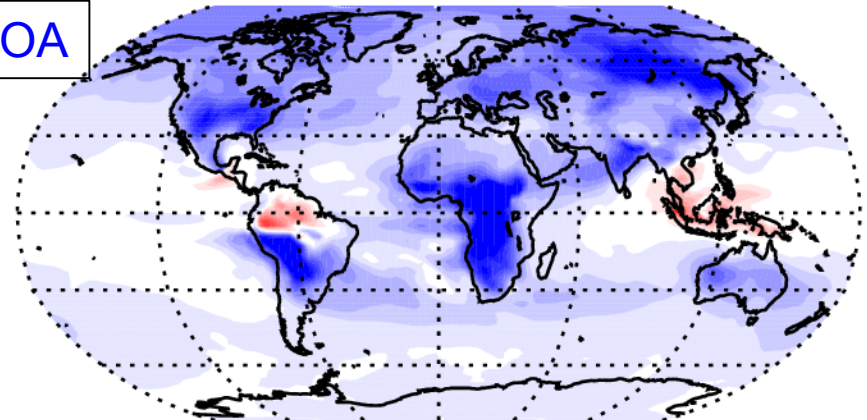
SOA

OA: OMA-SOA

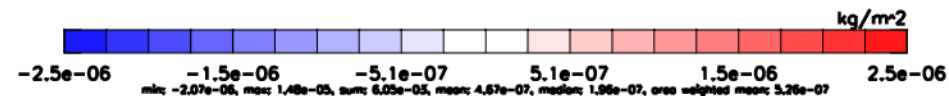
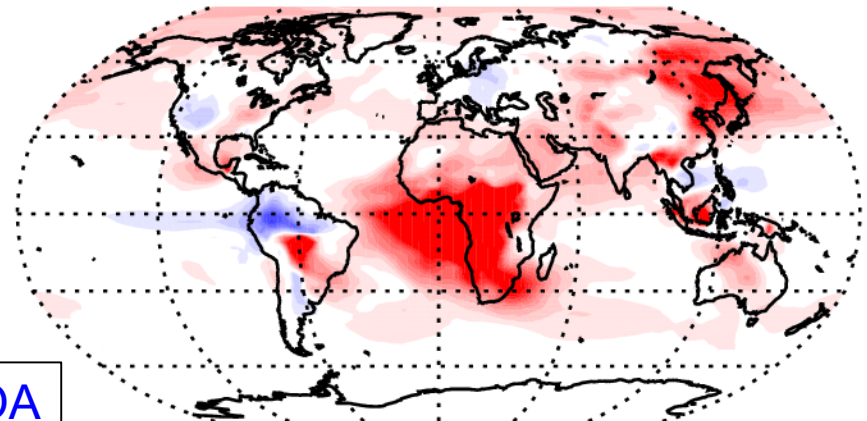


noSOA - SOA

OA: OMA-noSOA - OMA-SOA



OA: OMA-VBS - OMA-SOA

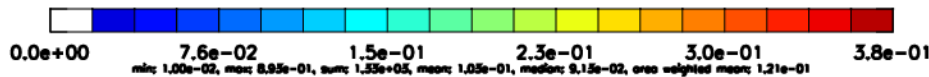
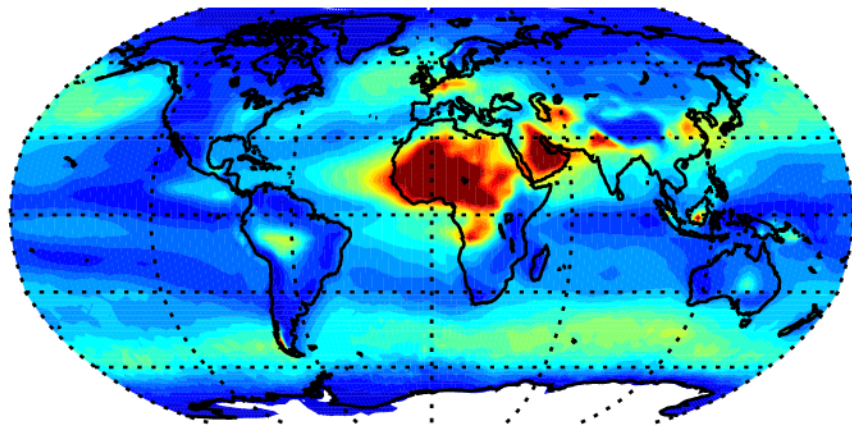


VBS - SOA

Aerosol Optical Depth @ 550 nm

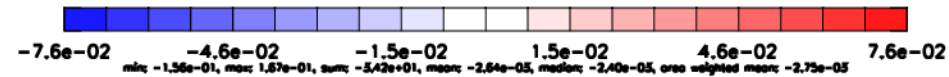
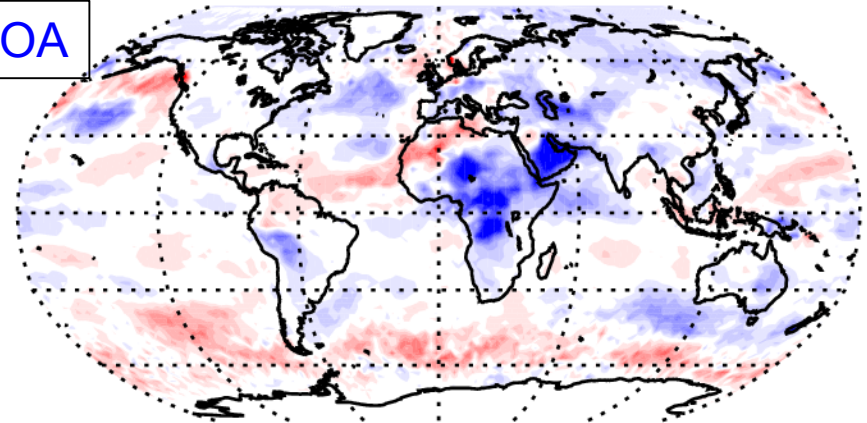
SOA

AOD: OMA-SOA

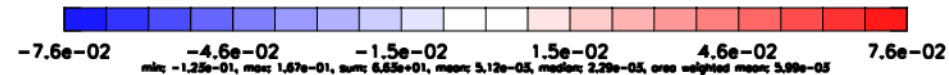
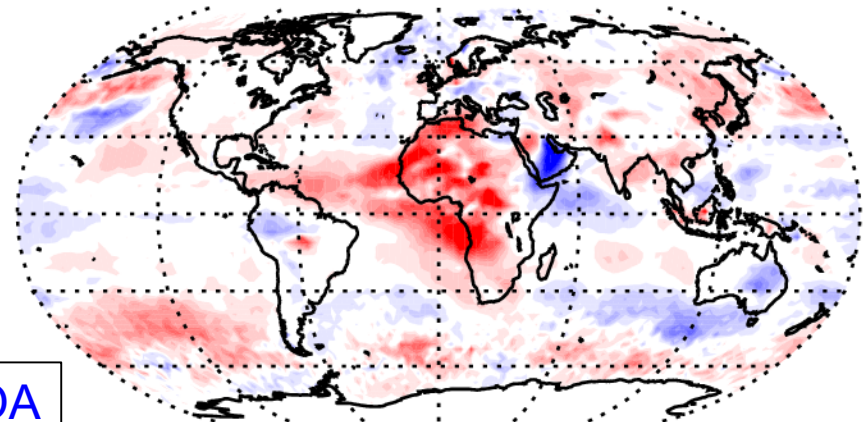


noSOA - SOA

AOD: OMA-noSOA - OMA-SOA



AOD: OMA-VBS - OMA-SOA



VBS - SOA

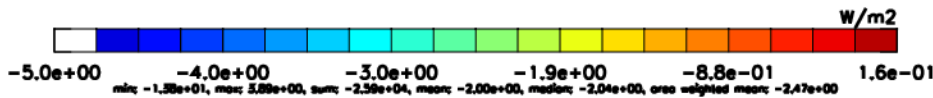
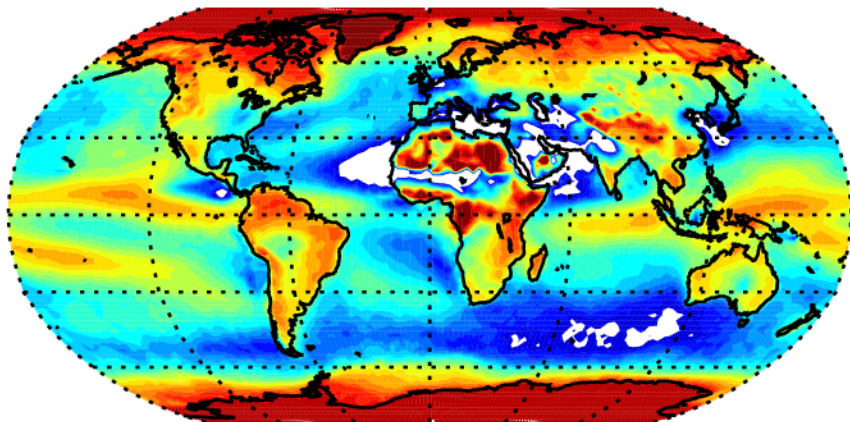
Shortwave aerosol forcing

noSOA - SOA

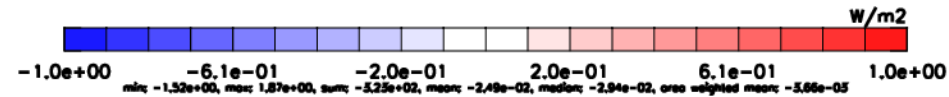
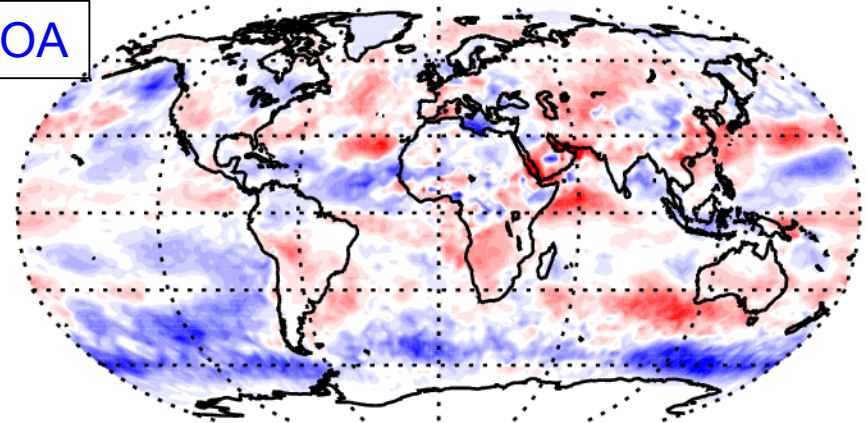
$\sim 0 \text{ W m}^{-2}$

SOA

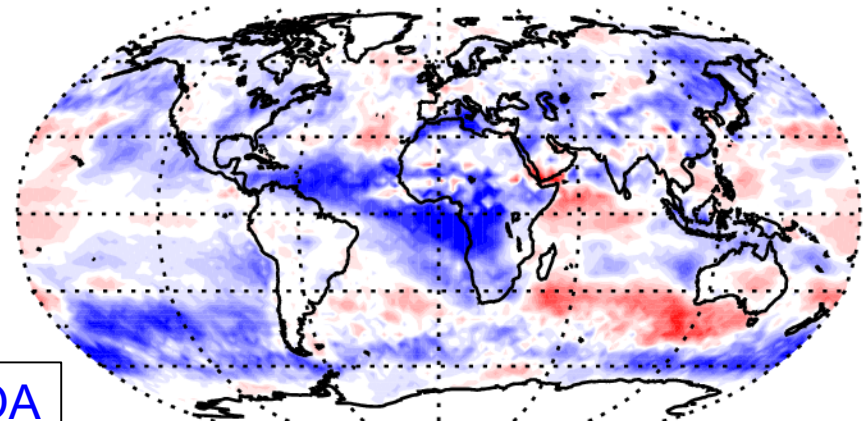
swf: OMA-SOA



swf: OMA-noSOA - OMA-SOA



swf: OMA-VBS - OMA-SOA



VBS - SOA

-0.14 W m^{-2}

Conclusions

- Aerosol microphysics do not significantly alter the mean OA vertical profile or comparison with surface measurements. This might not be the case for semi-volatile OA with microphysics.
- The inclusion of some (or all) of **OA as semi-volatile** strongly impacts their vertical profile, with climate implications.

Application against high altitude measurements:
Bauer ([A51N-0269](#))

VBS with microphysics:
Gao, Tsigaridis and Bauer ([A43G-0371](#))

Extra

Comparison with surface measurements

